Importation of *Foeniculum vulgare* Miller (Fennel) as Fresh Leaves and Stems From El Salvador, Guatemala, Honduras, and Nicaragua into the Continental United States

A Qualitative, Pathway-Initiated Risk Assessment

August 22, 2001

United States Department of Agriculture
Animal and Plant Health Inspection Service
Plant Protection and Quarantine
Commodity Risk Assessment Staff
4700 River Road, Unit 133
Riverdale, MD 20737–1236

CONTENTS

A. Introduction

This risk assessment (RA) was prepared for the Animal and Plant Health Inspection Service (APHIS), U.S. Department of Agriculture (USDA) under Purchase Order Number 43–6395–0–2185 (dated June 27, 2000). The project was supported by the U.S. Agency for International Development under Project Hurricane Mitch Economic Initiative.

The purpose of this RA is to examine pest risks associated with the importation into the United States of fresh leaves and stems of *Foeniculum vulgare* (fennel) from El Salvador, Guatemala, Honduras, and Nicaragua. The RA is a qualitative one in which risk is expressed in terms such as high and low rather than in numerical terms such as probabilities or frequencies. The details of the methodology and rating criteria can be found in *Pathway-Initiated Pest Risk Assessments: Guidelines for Qualitative Assessments, Version 5.0* (USDA, 2000a)**.**

Regional and international plant protection organizations—e.g., the North American Plant Protection Organization (NAPPO) and the International Plant Protection Convention (IPPC) administered by the Food and Agriculture Organization (FAO) of the United Nations—provide guidance for conducting pest risk analyses. The methods used to initiate, conduct, and report this RA are consistent with guidelines provided by NAPPO and FAO. Our use of biological and phytosanitary terms conforms to "Definitions and Abbreviations" (Introduction Section) of *International Standards for Phytosanitary Measures, Section 1—Import Regulations: Guidelines for Pest Risk Analysis* (FAO, 1996).

The FAO guidelines describe three stages of pest risk analysis: Stage 1 (initiation), Stage 2 (risk assessment), and Stage 3 (risk management). This document satisfies the requirements of FAO Stages 1 and 2.

B. Risk Assessment

1. Initiating Event: Proposed Action

This RA is commodity based and therefore "pathway-initiated." It was conducted in response to a request for the USDA to authorize the importation of a particular commodity presenting a potential plant pest risk. The importation into the United States of fresh leaves and stems of *Foeniculum vulgare* (fennel) as a commodity from El Salvador, Guatemala, Honduras, and Nicaragua is a potential pathway for the introduction of plant pests. The regulatory authority for the importation of fruits and vegetables from foreign sources into the United States may be found in the Code of Federal Regulations (7CFR§319.56).

2. Assessment of Weediness Potential

The results of weediness screening for *Foeniculum vulgare* from El Salvador, Guatemala, Honduras, and Nicaragua (Table 1) did not prompt a pest-initiated risk assessment.

Table 1. Process for Determining Weediness Potential of the Commodity

Commodity: Fresh leaves and stems of *Foeniculum vulgare* Mill. (fennel) [Apiaceae] for consumption.

Phase 1: The species is grown as a minor commercial crop and in gardens throughout the United States.

Phase 2: Is the species listed in:

YES *Geographical Atlas of World Weeds* (Holm, *et al.*, 1979).
This species is reported as a principal weed in Mexico and New Zealand; as a common weed in Argentina, Australia. Hawaii, and Spain; as present in Chile, Morocco, Uruguay, and the United States as of unknown importance; and is part of the flora but not known as a weed in Afghanistan and Israel.

NO *World's Worst Weeds* (Holm, *et al.*, 1977).

NO *Report of the Technical Committee to Evaluate Noxious Weeds; Exotic Weeds for the Federal Noxious Weed Act* (Gunn and Ritchie, 1982).

NO *Economically Important Foreign Weeds* (Reed, 1977).

YES *Composite List of Weeds* (Weed Science Society of America, 1989).

NO *World Weeds* (Holm, *et al.*, 1997).

NO Is there any literature reference indicating weediness (e.g., AGRICOLA, CAB, and AGRIS search on "species name" combined with "weed").

Foeniculum vulgare has been characterized as an invasive species (USDA, 2000b).

Phase 3: Conclusion: The plant species is widely dispersed in the United States and is present in at least 37 States (USDA, 2000b). The weediness potential of imported commodity is considered as negligible, even though the species is invasive, since the species is already widespread and seeds are available in the United States for planting. Furthermore, seeds are not usually associated with the commodity imported for consumption.

3. Previous Risk Assessments, Decision History, and Pest Interceptions

Previous history for the four countries. None

Plant Protection and Quarantine interception records (APHIS, 2000).
One interception from Guatemala: Lepidoptera sp. with the stem of fennel.

Note: The risk status of this interception is discussed following Table 2 on page 4, under "Discussions."

4. Pest Categorization

The pests that have been reported in the scientific and regulatory literature on fennel in the four countries are recorded in Table 2. Table 2 also presents information about geographic distribution, host associations and regulatory data. Table 2 represents a "master list" of these organisms and serves as a basis for selecting pests for more detailed biological analysis.

Table 2. Pests Associated with *Foeniculum vulgare* from El Salvador, Guatemala, Honduras, and Nicaragua

Pest Name (Order: Family)	Geographic Distribution[1]	Plant Part Affected[2]	Quarantine Pest[3]	Likely to Follow Pathway[3]	References
ARTHROPODS					
Agrotis segetum Denis & Schiffermüller[4] (Lepidoptera: Noctuidae)	HO	L, S, R	Y	Y	CABI, 2000; Carter, 1984; IIE, 1987; Salgado-Cambar, 2000
Aphis spiraecola Patch (Homoptera: Aphididae)	ES, HO, US	Fw, L, S	N	Y	Blackman and Eastop, 2000; CABI, 2000; IIE, 1969
Cavariella aegopodii (Scopoli) (Homoptera: Aphididae)	HO, US	L	N	Y	CABI, 2000; Blackman and Eastop, 2000; Hill, 1994; Salgado-Cambar, 2000
Myzus persicae Sulzer (Homoptera: Aphididae)	ES, GU, HO, US	L	N	Y	Blackman and Eastop, 2000; CABI, 2000; IIE 1979; Metcalf and Metcalf, 1993
Papilio polyxenes Fabricius (Lepidoptera: Papilionidae)	HO, US	Fw, L	N	Y	CABI, 2000; Hill,1994; Metcalf and Metcalf, 1993; Salgado-Cambar, 2000; Passoa, 1983
BACTERIA					
Erwinia carotovora (Jones) subsp. *carotovora* Bergey, *et al.* (Enterobacteriales: Enterobacteriaceae)	HO, US	L	N	Y	ARS, 1960; CABI, 2000; Salgado-Cambar, 2000

Table 2. Pests Associated with *Foeniculum vulgare* from El Salvador, Guatemala, Honduras, and Nicaragua

Pest Name (Order: Family)	Geographic Distribution[1]	Plant Part Affected[2]	Quarantine Pest[3]	Likely to Follow Pathway[3]	References
Pseudomonas syringae van Hall (Pseudomondales: Pseudomondaceae)	ES, GU, HO, US	W	N	Y	CABI, 2000; Salgado-Cambar, 2000
FUNGI					
Alternaria alternata (Fr.:Fr.) Keissl. f. sp. *lycopersici* (Deuteromycotina: Hyphomycetes)	HO, US	L	N	Y	CABI, 2000; Salgado-Cambar, 2000
Erysiphe heraclei DC (Pyrenomycetes: Erysiphales)	HO, US	L	N	Y	ARS, 2000; Salgado-Cambar, 2000
Fusarium oxysporum Schlech.: Fr. (Deuteromycotina: Hyphomycetes)	HO, US	W	N	Y	ARS, 2000; Salgado-Cambar, 2000
Sclerotinia sclerotiorum (Lib.) de Bary (Discomycetes: Helotiales)	HO, US	W	N	Y	ARS, 1960; ARS, 2000; CABI, 2000; Salgado-Cambar, 2000
NEMATODES					
Rotylenchulus reniformis Linf. & Oliveira (Tylenchida; Rotylenchulidae)	HO, US	R	N	N	CABI, 2000

[1] ES = El Salvador, GU = Guatemala, HO = Honduras, US = United States
[2] Fw = Flowers, L = Leaves, R = Roots, S = Stems, W = Whole plant
[3] Y = Yes, N = No
[4] Reported in the correspondence (Salgado-Cambar, 2000) but not confirmed by a literature search.

Discussions. The absence of taxonomic information at the species level, makes biological evaluations difficult. Consequently, the interception record from Guatemala of Lepidoptera sp. is not analyzed further. Species of Lepidoptera are found on fennel in the United States. Quarantine action will be taken if a Lepidoptera species is found on commercial or other shipments of fennel.

Any pest species listed in the above pest list that has a "Y" in the "Quarantine Pest" column is considered to be a quarantine pest of *F. vulgare* from any of the four countries. Should any of these pests be intercepted on commercial (or any other) shipments of stems and leaves of *F. vulgare,* quarantine action will be taken. "N" is used in the quarantine pest column to denote a pest that is not a quarantine pest.

Only those quarantine pests that can reasonably be expected to follow the pathway; i.e., be included in commercial shipments of fresh fennel leaves and stems, were analyzed in detail. Only quarantine pests that have a "Y" in both the "Likely to Follow Pathway" and in the "Quarantine Pest" columns were selected for further analysis in Tables 3, 4, and 5.

5. Consequences of Introduction

Agrotis segetum from Table 2 is considered for further analysis according to the five risk elements (REs) described in the Guidelines (USDA, 2000a).

Table 3. Risk Rating for Consequences of Introduction

Pest Species	RE #1 Climate/host Interaction	RE #2 Host Range	RE #3 Dispersal Potential	RE #4 Economic Impact	RE #5 Environ-mental Impact	Cumulative Risk Rating
Agrotis segetum	High 3	High 3	High 3	High 3	Medium 2	High 14

6. Likelihood of Introduction

The ratings for the six subelements (SEs) concerning the "Likelihood for Introduction" are shown in Table 4.

Table 4. Risk Rating for Likelihood of Introduction

Pest Species	SE #1 Quantity imported annually	SE #2 Survive post-harvest treatment	SE #3 Survive shipment	SE #4 Not detected at port of entry	SE #5 Moved to a suitable habitat	SE #6 Contact with host material	Cumulative Risk Rating
Agrotis segetum	Medium 2	Medium 2	High 3	Medium 2	High 3	High 3	High 15

7. Conclusion

Pest risk potential rating for the pest listed in Tables 3 and 4 is shown in Table 5.

Table 5. Pest Risk Potential

Pest Species	Consequences of Introduction. (Cumulative Risk Rating)	Likelihood of Introduction (Cumulative Risk Rating)	Risk Potential[1]
Agrotis segetum	High 14	High 15	High 29

[1] Pest Risk Potential (USDA, 2000a).

Pest Risk potential ratings have the following suggested meanings (USDA, 2000a):

"Low: Pest will typically not require specific mitigation procedures. The port-of-entry inspection to which all imported commodities are subjected can be expected to provide sufficient phytosanitary security.

Medium: Specific phytosanitary measures may be necessary.

High: Specific phytosanitary measures are strongly recommended. Port-of-entry inspection is not considered sufficient to provide phytosanitary security."

As stated in the *Guidelines* (USDA, 2000a), detailed examination and choice of appropriate sanitary and phytosanitary measures to mitigate pest risk for pests with particular pest risk potential scores or ratings is undertaken as part of the pest risk management phase and is not discussed in this document. The appropriate risk management strategy for a particular pest depends on the risk posed by that pest.

C. Literature Cited

APHIS. 2000. Lists of intercepted pests attached to Purchase Order Number 43–6395–0–2185, dated June 27, 2000. USDA, APHIS. Riverdale, Maryland.

ARS. 1960. Index of Plant Disease in the United States. Agr. Handb. 165, U. S. Dept. Agr., Washington, DC. 531 pp. (Reviewed and reissued in 1970).

ARS. 2000. Fungal Data Base, Systematic Botany and Mycology Laboratory, Agricultural Research Service, USDA. *(http://nt.ars-grin.gov/SBMLweb/Databases/DatabaseHome.htm).*

Blackman, R. L. and Eastop, V. F. 2000. Aphids on the World's Crops. An Identification and Information Guide. John Wiley & Sons, New York, New York. 375 pp.

CABI. 2000. Crop Protection Compendium. Global Module, 2nd ed. CAB International, Wallingford, United Kingdom.

Carter, David J. 1984. Pest Lepidoptera of Europe, With Special Reference to the British Isles. Series Entomologica. Dr. W. Junk Publishers, Dordrecht, The Netherlands. pp. 294–296.

FAO. 1996. International Standards for Phytosanitary Measures. Part 1—Import Regulations: Guidelines for Pest Risk Analysis. Secretariate of the International Plant Protection Convention, Food and Agriculture Organization (FAO) of the United Nations. Rome, Italy. 21 pp.

Gunn, C. R. and Ritchie, C. 1982. 1982 Report of the Technical Committee to Evaluate Noxious Weeds; Exotic Weeds for Federal Noxious Weed Act. 335 pp. (Unpublished).

Hill, D. S. 1994. Agricultural Entomology. Timber Press, Portland, Oregon. 635 pp.

Holm, L. G., Doll, J., Holm, E., Pancho, J. V., and Herberger, J. P. 1997. World Weeds: Natural Histories and Distribution. John Wiley & Sons, New York, New York. 1129 pp.

Holm, L. G., Pancho, J. V., Herberger, J. P., and Plucknett, D. L. 1979. A Geographical Atlas of World Weeds, (Second printing, 1991). Krieger Publishing Co., Malabar, Florida. 391 pp.

Holm, L. G., Plucknett, D. L., Pancho, J. V., and Herberger, J. P. 1977. The World's Worst Weeds. University Press of Hawaii, Honolulu, Hawaii. 609 pp.

IIE. 1969. International Institute of Entomology Series, Map 265, *Aphis spiraecola* Patch Commonwealth Agricultural Bureau International, Wallingford, United Kingdom.

IIE. 1979. International Institute of Entomology Series, Map 45, *Myzus persicae* Sulzer Commonwealth Agricultural Bureau International, Wallingford, United Kingdom.

IIE. 1987. International Institute of Entomology Series, Map 490, *Agrotis segetum* Denis Commonwealth Agricultural Bureau International, Wallingford, United Kingdom.

Metcalf, R. L. and Metcalf, R. A. 1993. Destructive and Useful Insects; Their Habits and Control. 5th Ed. McGraw-Hill, New York, New York. (Pages are not numbered).

Passoa, S. 1983. Lista de los Insectos Asociados con los Granos Basicos y otras cultivos selectos en Honduras. CEIBA 25 (1):57.

Reed, C. F. 1977. Economically Important Foreign Weeds. Agriculture Handbook No. 498. United States Dept. Agriculture, Agricultural Research Service/Animal and Plant Health Inspection Service, Washington, DC. 746 pp.

Salgado-Cambar, E. 2000. Letter from Eduardo Salgado-Cambar, Sub Director Tecnico de Sanidad Vegetal de Honduras. Tegucigalpa, Honduras, dated September 5, 2000.

USDA. 2000a. Guidelines for Pathway-initiated Pest Risk Assessments, Version 5.0 .USDA, APHIS, PPQ, Commodity Risk Assessment Unit, Riverdale, Maryland.

USDA. 2000b. Natural Resources Conservation Data Base, Plants Version 3.0. *(http://plants.usda.gov)*.

Weed Science Society of America. 1989. Composite List of Weeds.

D. Preparers

Robert P. Kahn, Plant Pathologist (consultant)
Philip Lima, Entomologist (consultant)

E. Acknowledgments

The authors gratefully acknowledge the external peer reviews made by the following entomologists and plant pathologists:

Robert Bellinger
Entomologist
Department of Entomology
107 Long Hall
Clemson University
Clemson, SC 29634–0365

David Clement
Plant Pathologist
University of Maryland
Home and Garden Center
12005 Homewood Road
Ellicott City, MD 21042

Robert Goth
Plant Pathologist
4213 Wicomico Avenue
Beltsville, MD 20705

Randy Griffin
Entomologist
Department of Entomology
107 Long Hall
Clemson University
Clemson, SC 29634–0365

Norm Leppla
Entomologist
Department of Entomology
University of Florida
Box 110630
Gainesville, FL 32611–0630

John Lightfield
Plant Pathologist
307 Cone Branch
Middletown, MD 21769